TFT LCD Approval Specification

MODEL NO.: G104V1-T01

Customer: _____

Approved by: _____

Note:

記錄	工作	審核	角色	投票
2006-08-15 11:53:32 CST	Approve by Dept. Mgr.(QA RA)	tomy_chen(陳永一 /52720/54140/43150)	Assignee	Accept
2006-08-10 18:17:48 CST	Approve by Director	teren_lin(林添仁/56910/36064)	Director	Accept

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REVISION HISTORY

Version	Date	Section	Description
Ver 2.0	Nov.07. 05	All	G104V1-T01 Specifications was first issued.
Ver 2.1	Aug.09 . 06	2.1	ABSOLUTE RATINGS OF ENVIRONMENT 1.Change the Operation Temp.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G104V1-T01 is an 10.4 inch TFT Liquid Crystal Display module with a 2-CCFL Backlight unit and a-31-pin-and-1ch-TTL interface. This module supports 640 x 480 VGA mode and can display 262,144 colors. The inverter module for Backlight is not built in.

1.2 FEATURES

- Wide viewing angle.
- High contrast ratio
- Fast response time
- High color saturation
- VGA (640 x 480 pixels) resolution
- Wide operating temperature
- DE (Data Enable) mode
- CMOS/TTL (Transistor –Transistor Logic) Interface
- Reversible - scan function

1.3 APPLICATION

-TFT LCD Monitor

-TFT LCD TV

- Factory Application
- Amusement
- Vehicle

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Diagonal Size	264.0 (10.4 inch)	mm	
Active Area	211.2x158.4	mm	(1)
Bezel Opening Area	215.4x161.8	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	640xR.G.B.x480	pixel	-
Pixel Pitch	0.33x0.33	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Display Mode	Normally Black	-	-
Surface Treatment	Hard Coating (3H), AG (Haze 25%)	-	-
Weight	470	g	

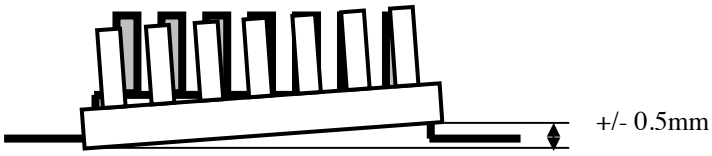
Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	225.0	225.5	226.0	mm	(1)
	Vertical(V)	175.8	176.3	176.8	mm	
	Depth(D)	-	9.5	10.0	mm	
I/F connector mounting position		The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.				(2)

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Connector mounting position



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

No.	Test Item	Test Condition	Note
1	High Temperature Storage Test	80℃, 240 hours	(1) (2)
2	Low Temperature Storage Test	-20℃, 240 hours	
3	Thermal Shock Storage Test	-20℃, 0.5hour⟷80℃, 0.5hour; 100cycles, 1hour/cycle	
4	High Temperature Operation Test	70℃, 240 hours	
5	Low Temperature Operation Test	-20℃, 240 hours	
6	High Temperature & High Humidity Operation Test	60℃, RH 90%, 240hours	
7	Heat Cycle Operation Test	-20℃, 1hour⟷70℃, 1hour; 50cycles, 4hour/cycle	
8	ESD Test (Operation)	150pF, 330Ω, 1sec/cycle Condition 1 : panel contact, ±8KV Condition 2 : panel non-contact ±15KV	(2)
9	Shock (Non-Operating)	220G, 2ms, half sine wave, 1 time for ± X, ± Y, ± Z.	(2)(3)
10	Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z	(2)(3)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

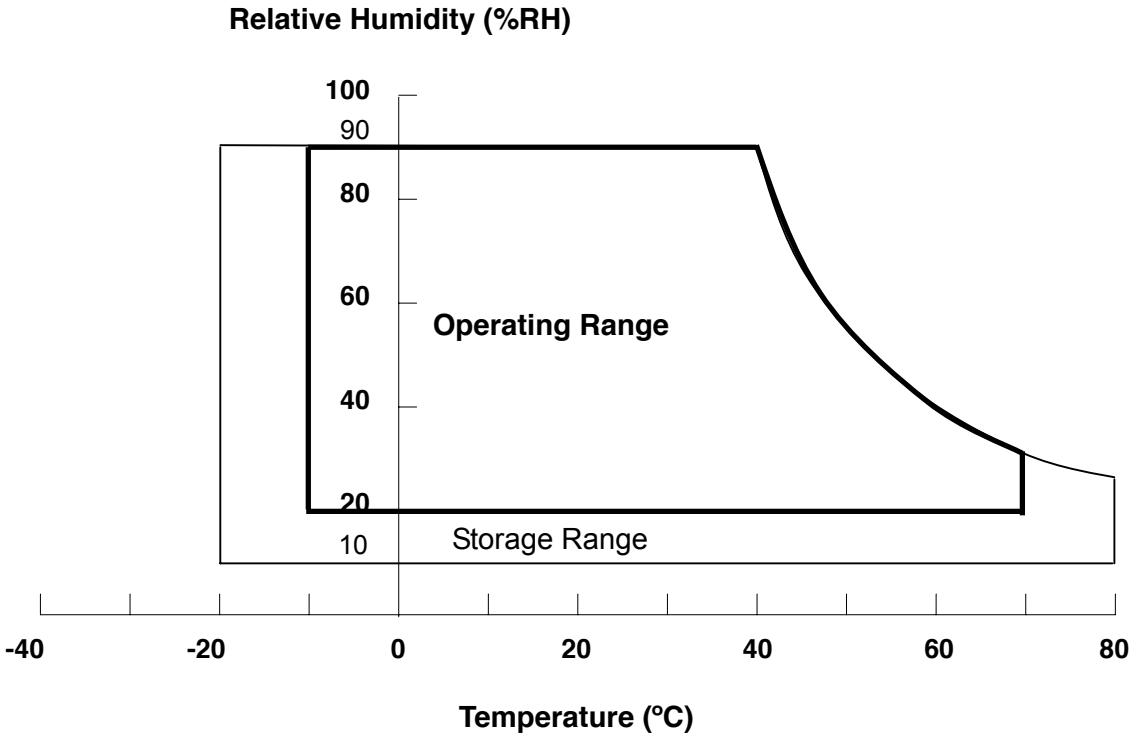
(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) No display malfunctions.

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

Note (4) The temperature of panel display surface area should be 80 ºC Max.



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	6.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	V_{CC} + 0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	2.5K	V_{RMS}	(1), (2), I_L = (5.5)mA
Lamp Current	I_L	2.0	6.0	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	45	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to 3.2 for further I_L information).

3. ELECTRICAL CHARACTERISTICS

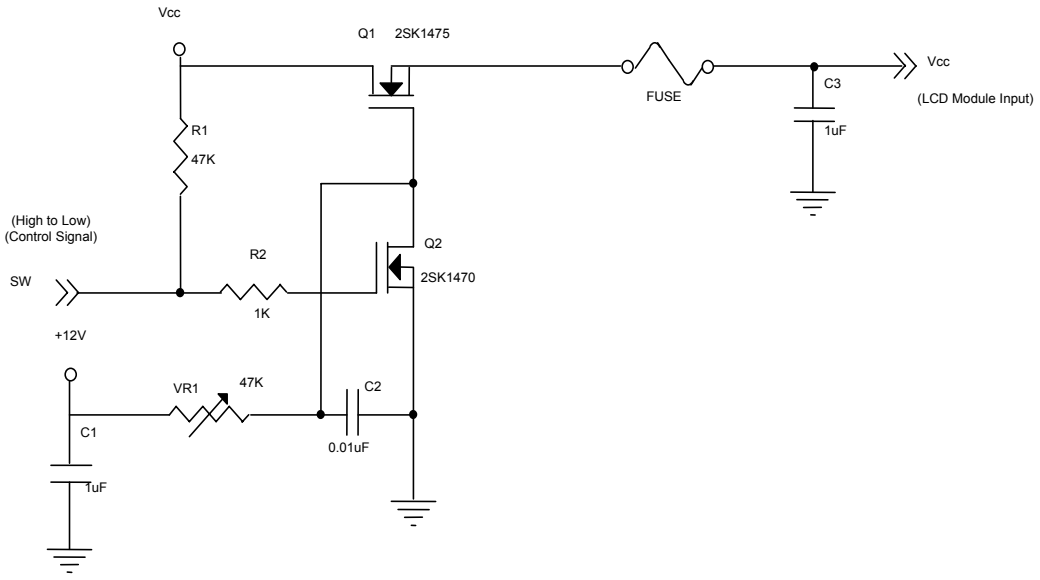
3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

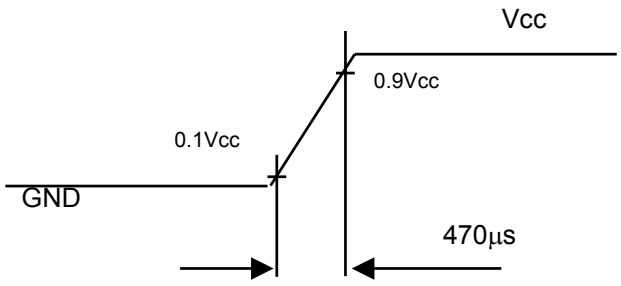
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	3.0	3.3 / 5	5.25	V	-
Ripple Voltage		V_{RP}	-	-	100	mV	-
Rush Current		I_{RUSH}	-	-	1	A	(2)
Power Supply Current	White	-	-	420	-	mA	(3)a
	Black	-	-	380	-	mA	(3)b
	Vertical Stripe	-	-	470	-	mA	(3)c
Logic input voltage		V_{IH}	0.7V_{CC}	-	V_{CC}	V	
		V_{IL}	0	-	0.3V_{CC}	V	

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions: V_{CC} = 3.3 V, Ta = 25 ± 2 ºC.



Vcc rising time is 470μs



Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

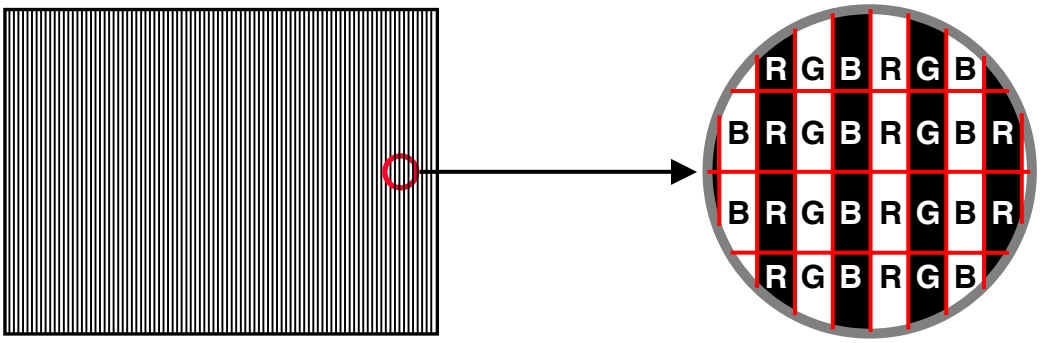
a. White Pattern

Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern



Active Area

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	440	490	540	V_{RMS}	(1), I_L = (5.5) mA
Lamp Current	I_L	2.0	5.5	6.0	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	770 (25°C)	V_{RMS}	(2)
		-	-	960 (0°C)	V_{RMS}	(2)
Operating Frequency	F_L	45	-	80	KHz	(3)
Lamp Life Time	L_{BL}	50,000	-	-	Hrs	(5)
Power Consumption	P_L	-	5.39	-	W	(4), I_L = 5.5 mA

Note (1) I_L means the lamp current of one lamp.

Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L \times 2$

Note (5) The lifetime of lamp can be defined as the time in which it continues to operate under the condition Ta = 25 ±2 °C and I_L = (5.5) mArms until one of the following events occurs:

(a) When the brightness becomes or lower than 50% of its original value.

(b) When the effective ignition length becomes or lower than 80% of its original value. (Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid producing too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

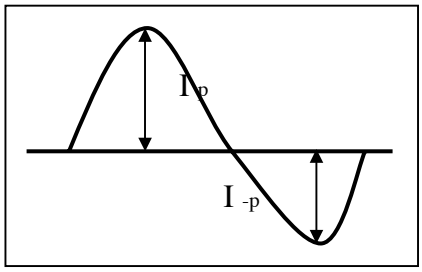
Requirements for a system inverter design, which is intended to have a better display performance, a

better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;

b. The distortion rate of the waveform should be within $\sqrt{2}$ ± 10%;

c. The ideal sine wave form shall be symmetric in positive and negative polarities.



* Asymmetry rate:

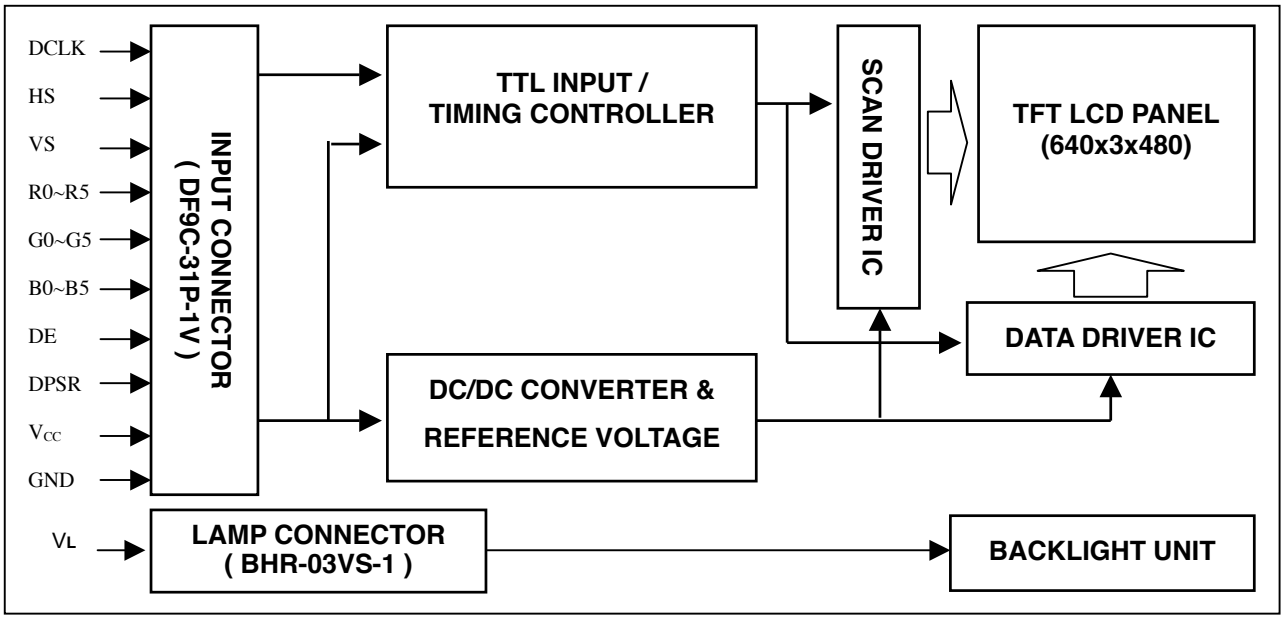
$| I_p - I_{-p} | / I_{rms} * 100\%$

* Distortion rate

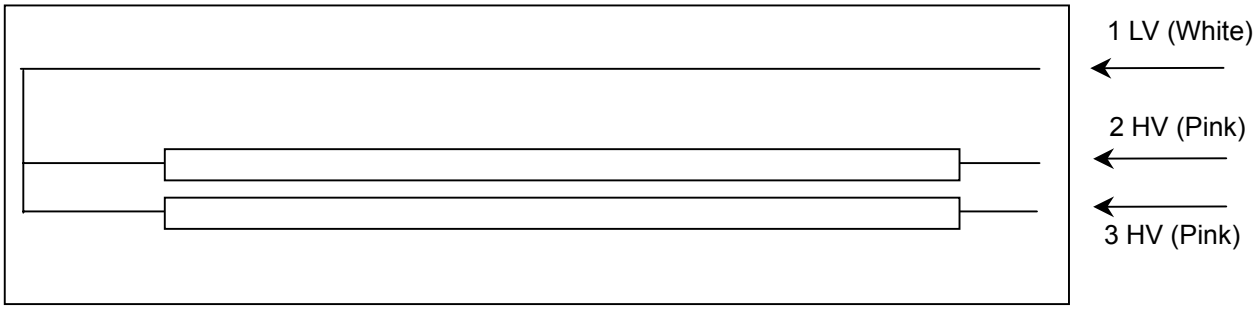
I_p (or I_{-p}) / I_{rms}

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Name	Description
1	GND	Ground
2	DCLK	Dot clock
3	HS	Horizontal synchronous
4	VS	Vertical synchronous
5	GND	Ground
6	R0	Red data (LSB)
7	R1	Red data
8	R2	Red data
9	R3	Red data
10	R4	Red data
11	R5	Red data (MSB)
12	GND	Ground
13	G0	Green data (LSB)
14	G1	Green data
15	G2	Green data
16	G3	Green data
17	G4	Green data
18	G5	Green data (MSB)
19	GND	Ground
20	B0	Blue data (LSB)
21	B1	Blue data
22	B2	Blue data
23	B3	Blue data
24	B4	Blue data
25	B5	Blue data (MSB)
26	GND	Ground
27	DE	Data enable signal
28	Vcc	Power supply
29	Vcc	Power supply
30	N.C.	Reserved, please keep it floating.
31	DPSR	Selection of scan direction

Note (1) Connector Part No.: DF 9C-31P-1V or equivalent.

5.2 SCANNING DIRECTION

The following figures are seen from a front view and the arrow shows the direction of scan.

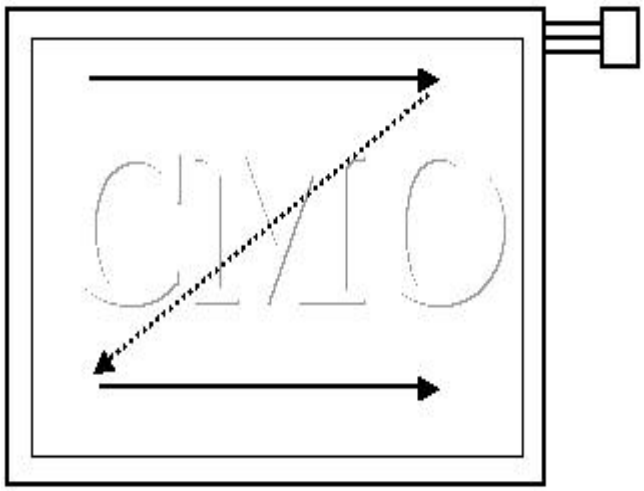


Figure1.Normal scan (DPSR : Low or Open)

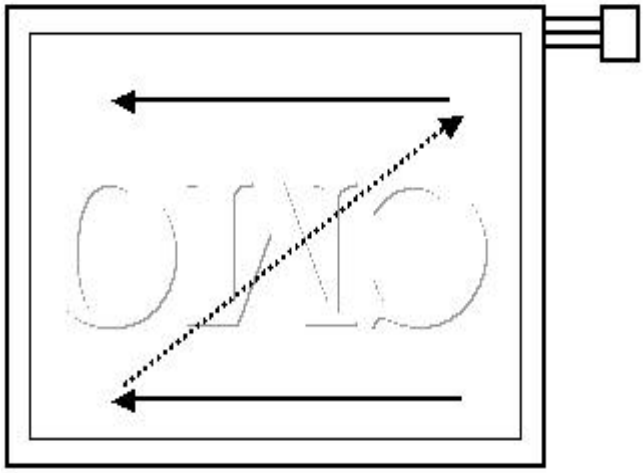


Figure 2. Reverse scan (DPSR : High)

5.3 BACKLIGHT UNIT

Pin	Symbol	Description	Remark
1	LV	Ground	White
2	HV1	High Voltage	Pink
3	HV2	High Voltage	Pink

Note (1) Connector Part No.: BHR-03VS-1 (J.S.T Mfg,Co,Ltd)

5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

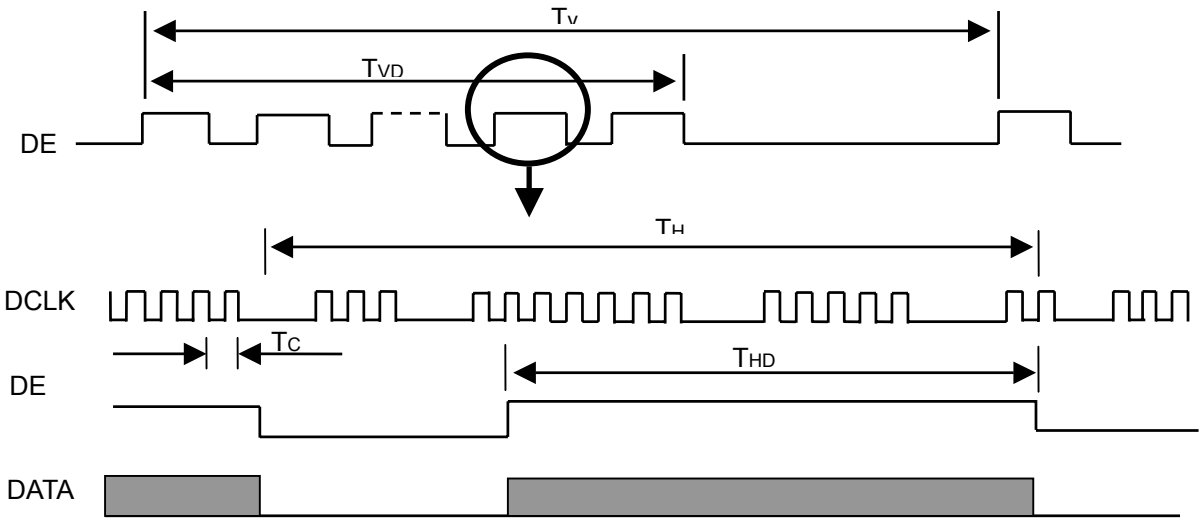
6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

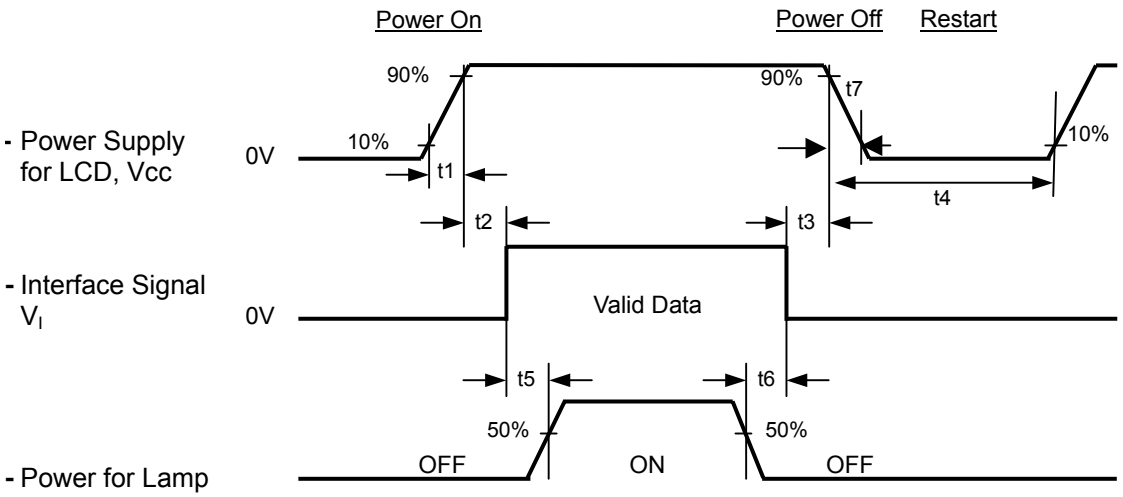
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Dot Clock	Frequency	Fc	21	25.175	29	MHz	-
	Duty		0.4	0.5	0.6		
Dot Data	Setup Time	Tlvs	8	-	-	ns	-
	Hold Time	Tlvh	12	-	-	ns	-
Vertical Active Display Term	Frame Rate	Fr	-	60	-	Hz	Tv=Tvd+Tvb
	Total	Tv	-	800	-	Th	-
	Display	Tvd	640	640	640	Th	-
	Blank	Tvb	-	160	Tv-Tvd	Th	-
Horizontal Active Display Term	Total	Th	-	525	-	Tc	Th=Thd+Thb
	Display	Thd	480	480	480	Tc	-
	Blank	Thb	-	45	Th-Thd	Tc	-

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Timing Specifications:

0.5 < t1 ≦ 10 ms

0 < t2 ≦ 50 ms

0 < t3 ≦ 50 ms

t4 ≧ 500 ms

t5 ≧ 200 ms

t6 ≧ 200 ms

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I_L	5.5	mA_{RMS}
Inverter Operating Frequency	F_L	61	KHz
Inverter	(Sumida IV40090T/B2)		

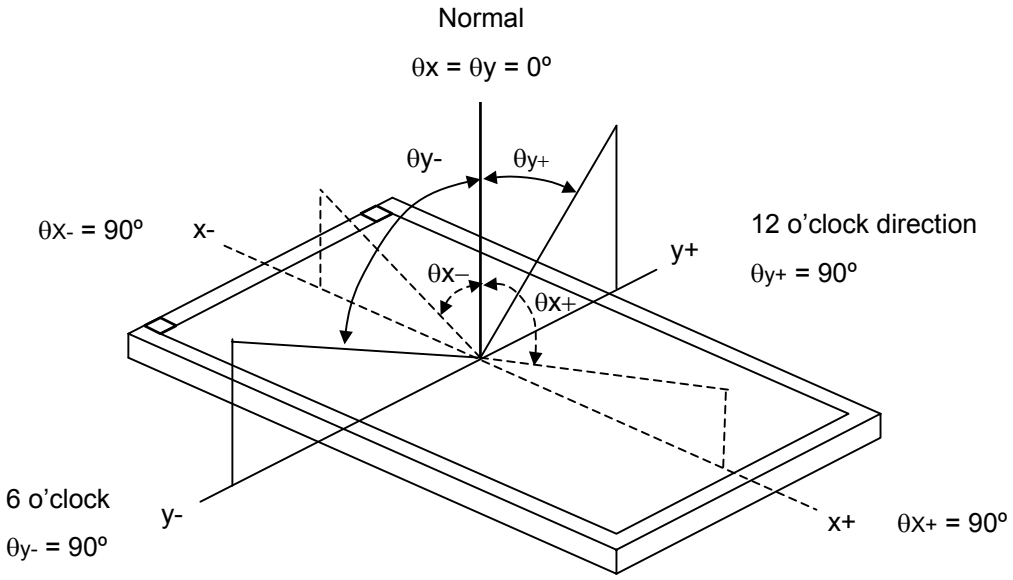
Note (1) I_L means the lamp current of one lamp.

7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rx	θ_x=0°, θ_Y =0°	Typ – 0.03	0.626	Typ + 0.03	-	(1), (6)
		Ry			0.348			
	Green	Gx			0.303			
		Gy			0.563			
	Blue	Bx			0.145			
		By			0.105			
	White	Wx			0.319			
		Wy			0.338			
Center Luminance of White		L_C		400	450	-	cd/m^2	(4), (6)
Contrast Ratio		CR		1000	1500	-	-	(2), (6)
Response Time		T_R		-	14	19	Ms	(3)
		T_F		-	9	14	Ms	
White Variation		δW		-	1.25	1.40	-	(5)
Viewing Angle	Horizontal	θ_x+	CR ≧ 10	80	88	-	Deg.	(1),
		θ_x-		80	88	-		
	Vertical	θ_Y+		80	88	-		
		θ_Y-		80	88	-		

Note (1) Definition of Viewing Angle (θx, θy):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

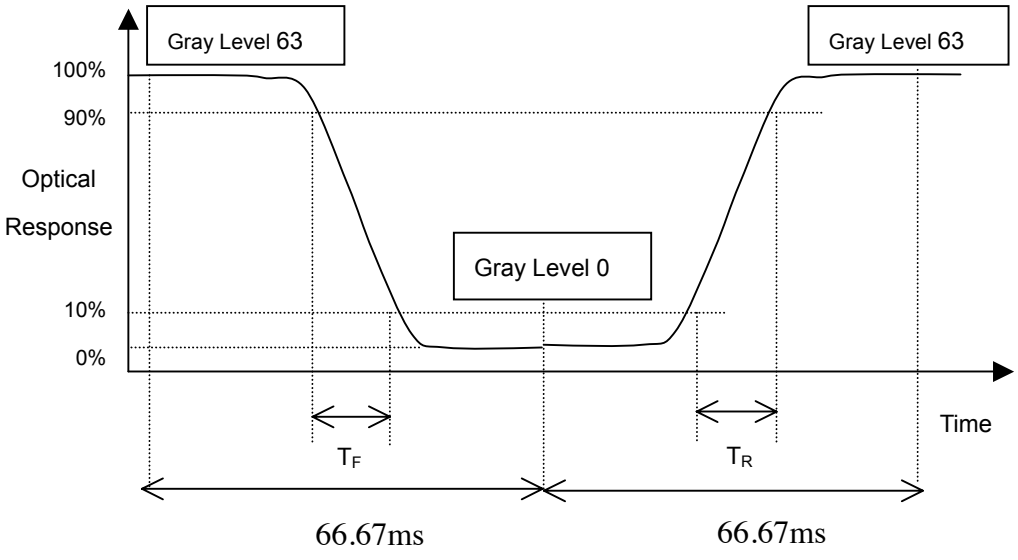
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

Note (3) Definition of Response Time (T_R, T_F) and measurement method:.



Note (4) Definition of Luminance of White (L_C):

Measure the luminance of gray level 63 at center point

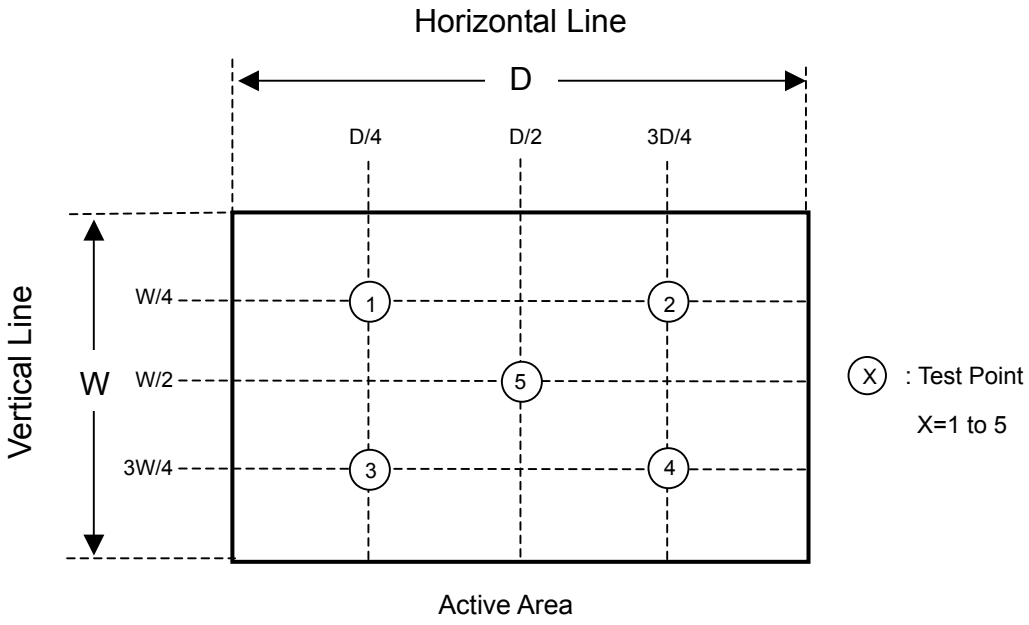
L_C = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (5).

Note (5) Definition of White Variation (δW):

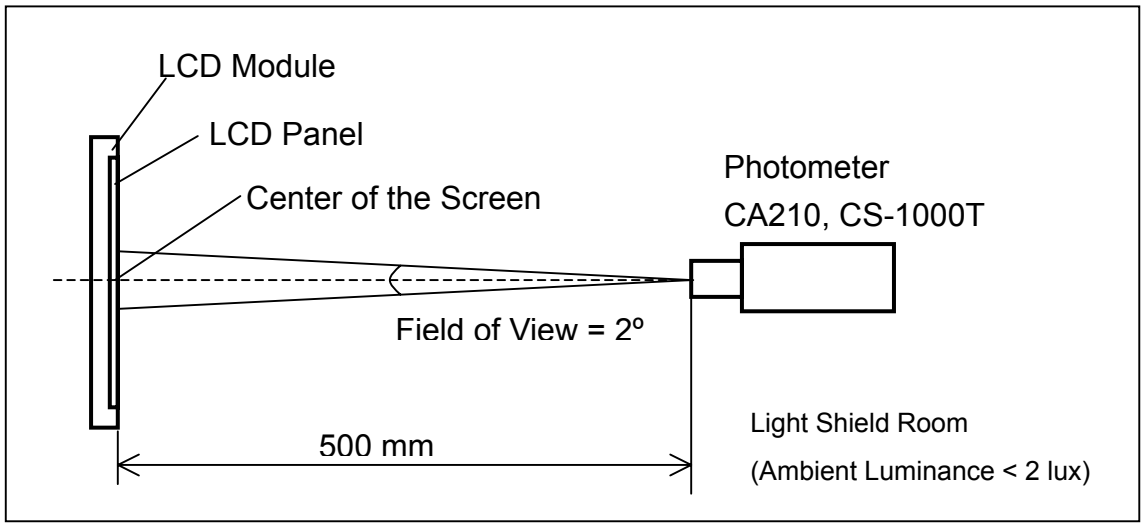
Measure the luminance of gray level 63 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]



Note (6) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



8. PACKAGING

8.1 PACKING SPECIFICATIONS

(1) 30 LCD modules / 1 Box

(2) Box dimensions: 500(L) X 400(W) X 330(H) mm

(3) Weight: approximately 15.5Kg (30 modules per box)

8.2 PACKING METHOD

(1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 1 - 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 60cm	Non Operation

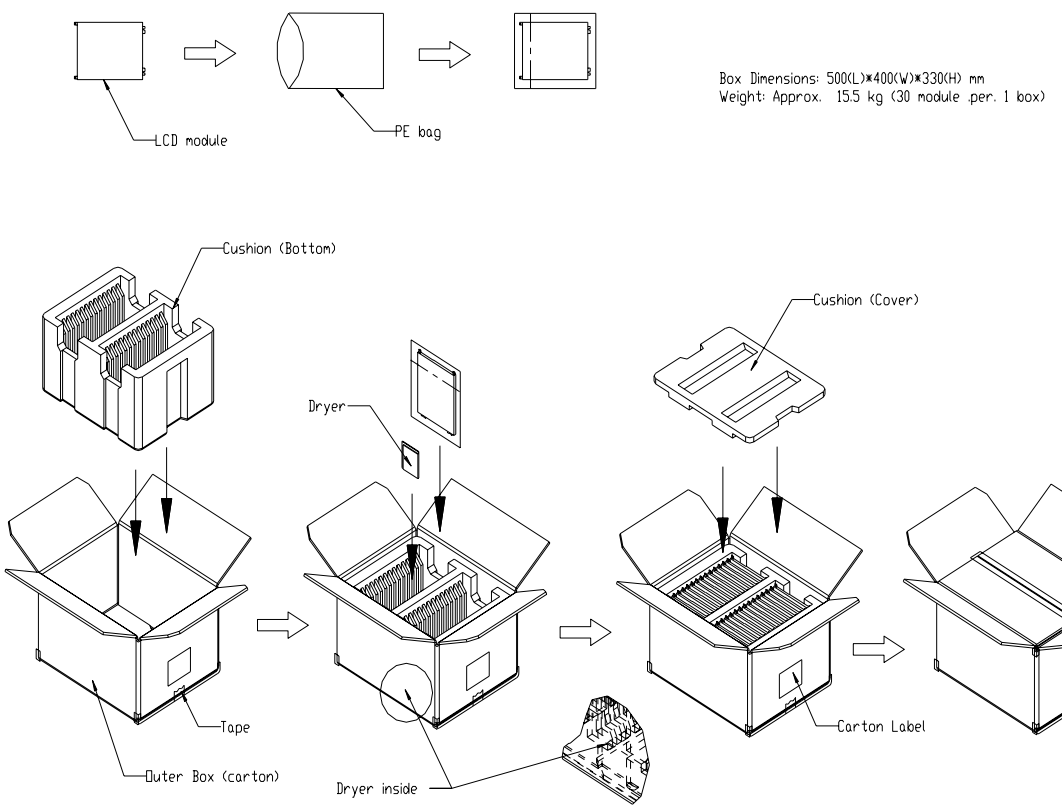


Figure. 8-1 Packing method

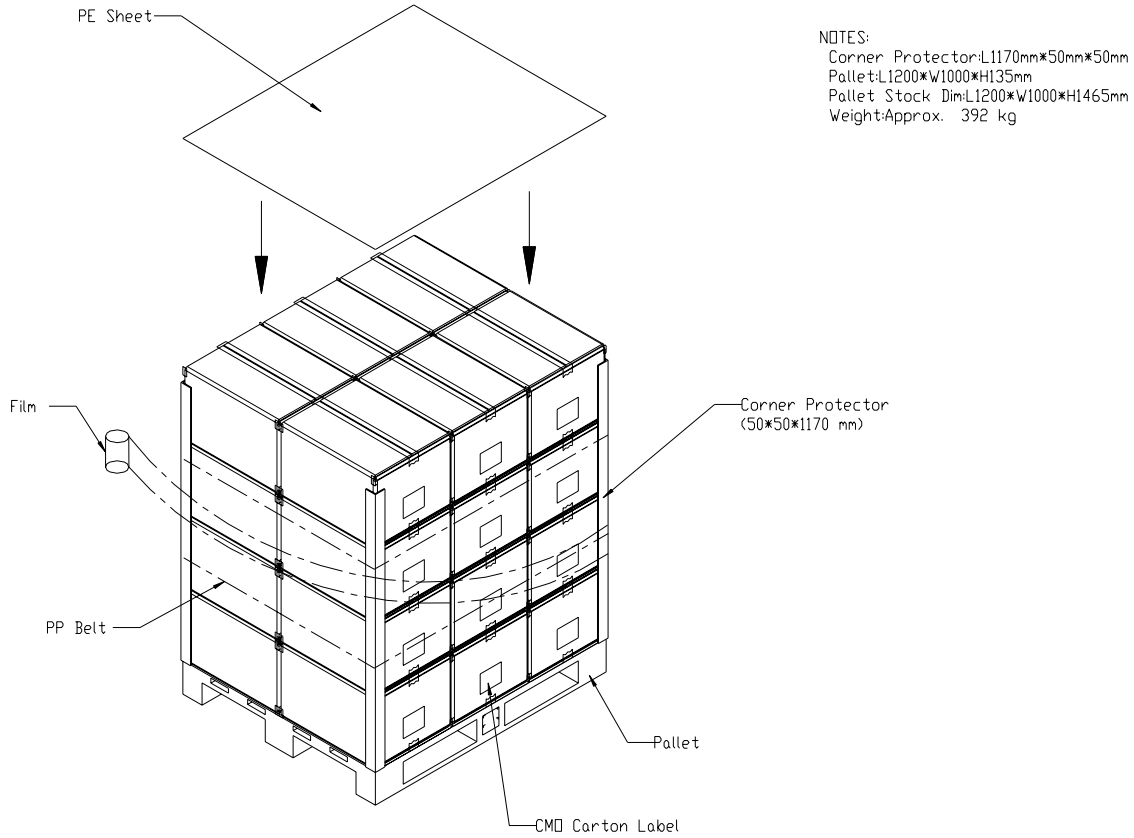
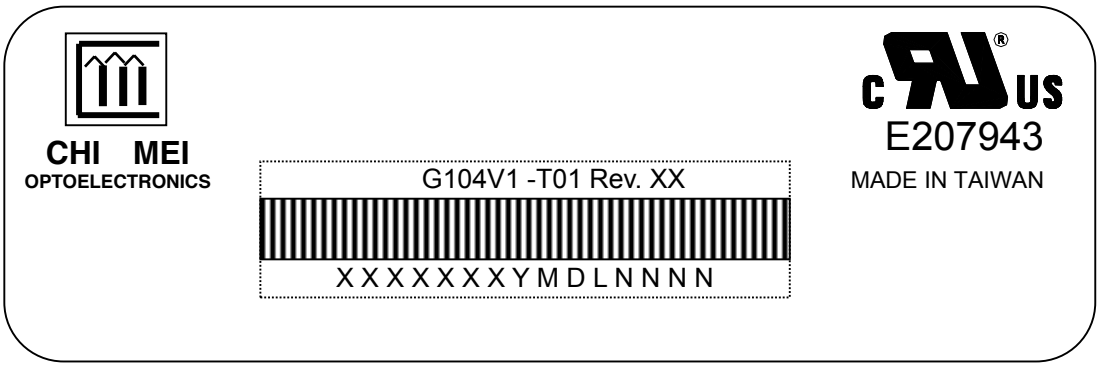


Figure. 8-2 Packing method

9. DEFINITION OF LABELS

9.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: G104v1 -T01

(b) Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) Serial ID: X X X X X X X Y M D L N N N N

- Serial No.
- Product Line
- Year, Month, Date
- CMO Internal Use
- CMO Internal Use
- Revision
- CMO Internal Use

Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2000~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I ,O, and U.

(b) Revision Code: Cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, …etc.

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

(5) Do not pull the I/F connector in or out while the module is operating.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

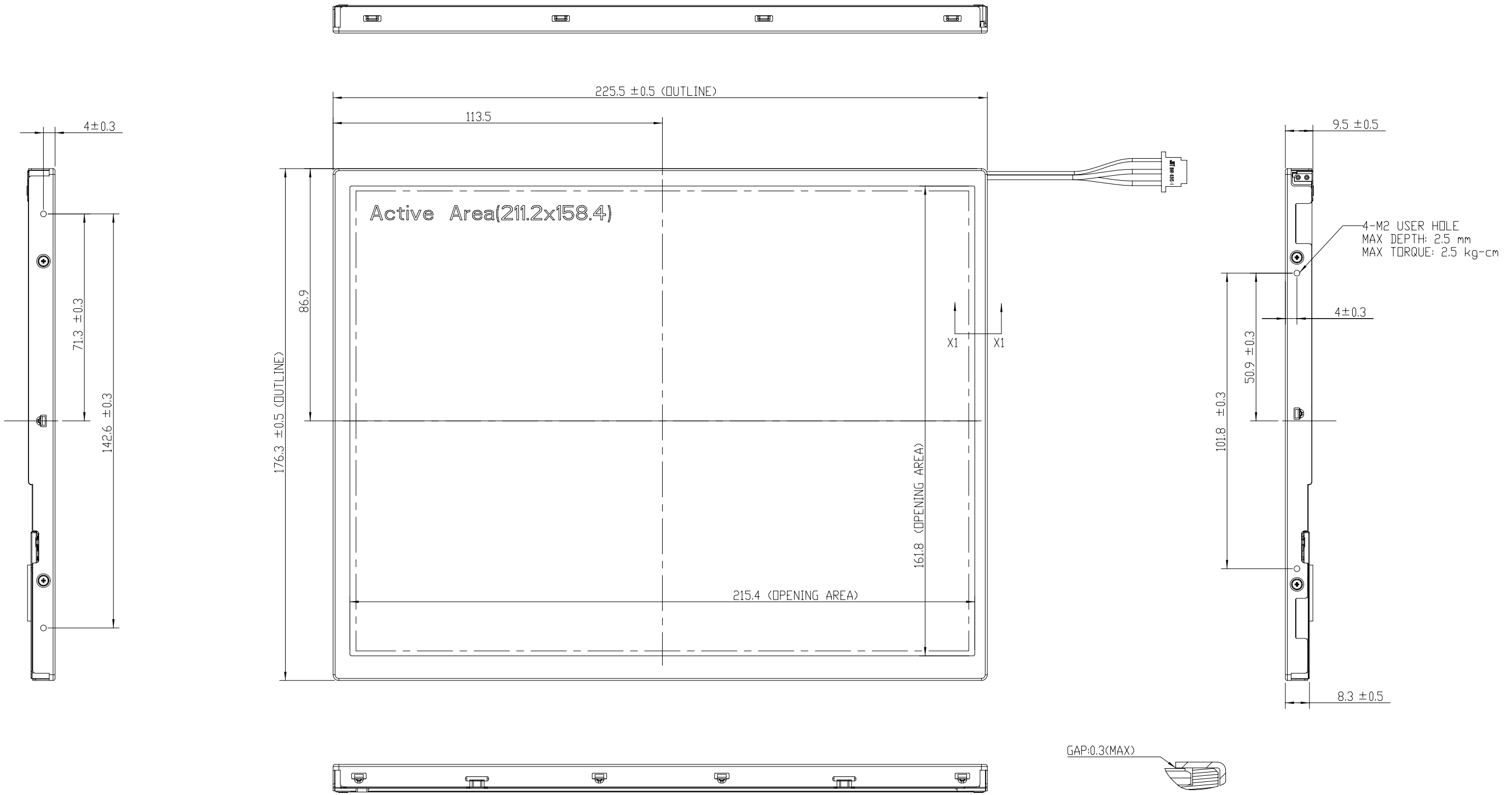
(10) When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

10.2 SAFETY PRECAUTIONS

(1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(3) After the module's end of life, it is not harmful in case of normal operation and storage.



NOTES:
1.OUTLINE TOLERANCE: ±0.5mm.
2."*" MARKS THE DESIGN CRITICAL DIMENSION.
3." Ⓟ" MARKS THE PROCESS CRITICAL DIMENSION.

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

TITLE	ASSY_MODULE_G104V1-T01					2D REV.	1
						3D REV.	1.12+
Approved	JEMMY_CHANG	Drawing No.	G104241011				
Checked	SHUBINHON	Part No.	GA4V101901				
Drawer	TIGER_CHANG	Material	TBD		Sheet	1 / 2	A2
Designer	TIGER_CHANG	Date	11-Apr-2005	Scale	1:1	Unit:mm	

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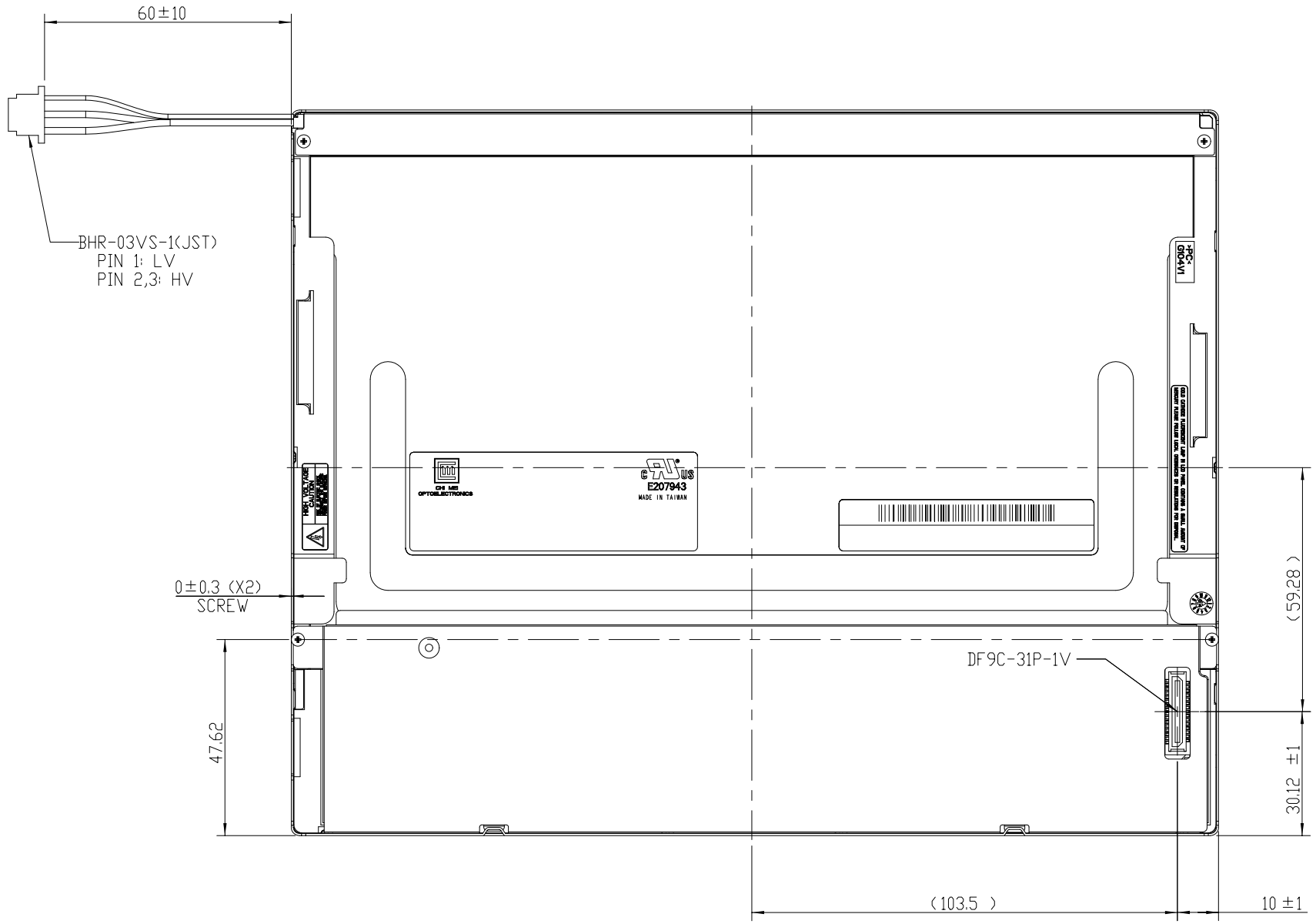

NOTES:
1.OUTLINE TOLERANCE: ±0.5mm.
2."*" MARKS THE DESIGN CRITICAL DIMENSION.
3." Ⓟ" MARKS THE PROCESS CRITICAL DIMENSION.

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

TITLE	ASSY_MODULE_G104V1-T01					2D REV.	2
						3D REV.	1.12+
Approved	JEMMY_CHANG	Drawing No.	G104241011				
Checked	SHUBINHON	Part No.	GA4V101901				
Drawer	TIGER_CHANG	Material	TBD		Sheet	2 / 2	A2
Designer	TIGER_CHANG	Date	11-Apr-2005	Scale 1:1	Unit:mm		

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